PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B65H 18/26

A1

(11) International Publication Number: WO 97/47545

(43) International Publication Date: 18 December 1997 (18.12.97)

(21) International Application Number: PCT/FI97/00358

(22) International Filing Date: 9 June 1997 (09.06.97)

(30) Priority Data:
962397 10 June 1996 (10.06.96) FI

(71) Applicant: VALMET CORPORATION [FI/FI]; Panuntie 6, FIN-00620 Helsinki (FI).

(72) Inventor: TURUNEN, Ismo; Pernajankuja 1 B 8, FIN-04430 Järvenpää (FI).

(74) Agent: FORSSÉN & SALOMAA OY; Yrjönkatu 30, FIN-00100 Helsinki (FI).

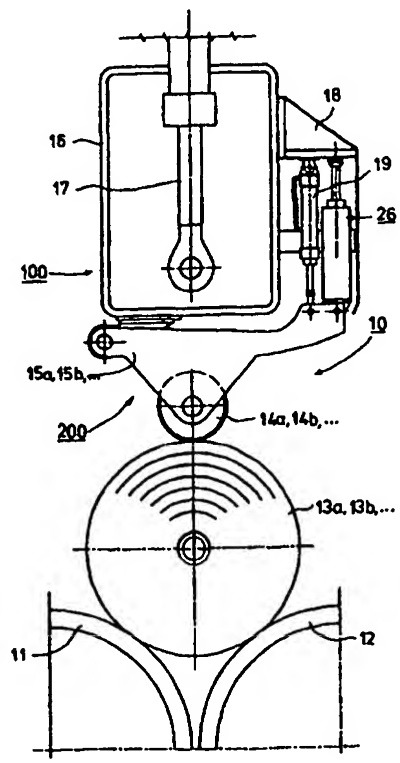
(81) Designated States: BR, CA, JP, KR, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: METHOD AND DEVICE IN WINDING

(57) Abstract

The invention concerns a method and a device in winding, wherein a number of separate web rolls (13a, 13b, etc.) are formed around separate roll cores placed one after the other side by side while supported by support members (11, 12) and while loaded by the rider roll loads produced by the rider rolls (14a, 14b, etc.) in the rider roll units (200) in a truncated rider roll (100). In disturbed winding the attachment of the rider roll unit/units (200) to the rider roll beam (16) is changed so that the rider rolls (14a, 14b, etc.) load the web rolls (13a, 13b, etc.) that are in a disturbed movement with a load substantially higher than the rider roll load (q_0) of normal winding.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

Method and device in winding

The invention concerns a method in winding, wherein a number of separate web rolls are formed around separate roll cores placed one after the other side by side while supported by support members and while loaded by the rider roll loads produced by the rider rolls in the rider roll units in a truncated rider roll.

Also, the invention concerns a device in winding, wherein a number of separate web rolls are formed around separate roll cores placed one after the other side by side while supported by support members and while loaded by the rider roll loads produced by the rider rolls in the rider roll units in a truncated rider roll.

Owing to variations in the cross-direction profiles of the web to be wound, such as thickness, moisture, and roughness, the diameters of the adjacent web rolls do not become precisely equally large in spite of the fact that, in principle, exactly equally long component webs are wound onto said rolls. Owing to the different diameters of the web rolls, the roll cores placed in their centres are displaced in relation to one another during the progress of the winding so that their centres of rotation are separated and, at the same time, minor variation also occurs in the angular speeds of the rolls. Since the web roll centres are, however, during the entire winding, in contact with one another, diverting forces arise between the winding cores, and the rolls tend to "jump", whereby the web rolls that are being formed can be damaged. Owing to this detrimental vibration, in drum winding, it is usually necessary to run more slowly, i.e. to be content with a lower winding speed, which reduces the capacity of the machine and is, thus, uneconomical.

The problem described above has occurred as long as winders of the drum winder type have been used. The seriousness of the problem has, however, varied in the course of years, because the profile of the web produced in a paper machine has

been improved and, at the same time, the roll size and the winding speed have been changed to a little extent only. In the last years, the diameters of the customer rolls produced have been made ever larger, and at the same time the winding speeds have also become higher, for which reason the problem of vibration has been manifested again: even a slight variation in the profile in the direction of width of the web is cumulated in particular during winding of thin paper grades so that the flaws of shape in the rolls arising from the profile of the web produce a significant problem of vibration.

With respect to the prior art, reference is made, e.g., to the *US Patent 5,320,299.* In this prior-art solution, the regulation of the rider roll load takes place either so that the common volume of hydraulic fluid in the hydraulic loading cylinders is closed and the load is regulated by means of the cylinders in the rider roll beam, or so that the rider roll beam is always at an invariable distance from the web roll faces and the pressure in the hydraulic loading cylinders is regulated by varying the pressure in the air space in the common container of hydraulic fluid. The solutions in said publication are concentrated on producing a uniform rider roll load on all the web rolls and on control of the regulation of the position and of the regulation of the load in the rider roll system.

It is a problem in the prior-art methods and devices that, when the web rolls move, the rider roll cannot support the web rolls sufficiently well, and the rider roll does not remain on the web roll faces. This problem occurs in all prior-art solutions in which an articulated rider roll is supported by pneumatic or hydraulic cylinders.

By means of the prior-art solutions, it is impossible to control the movements of web rolls arising from disturbance in the winding, in particular in the initial stage of the disturbance, in which the movements of the web rolls are still little. This comes from the following reasons:

— Hydraulic/pneumatic cylinders do not react to very little movements, which are absorbed in the resilience of their seals. The movements of the web rolls

occur as very little movements in the truncated rider roll, because the principal movement of the web rolls takes place in the horizontal direction, whereas the rider roll can support them in the vertical direction only. Thus, by means of a prior-art solution, it is impossible to interfere with disturbing movements of the web rolls right in the initial stage of the movements, but the disturbance can increase freely. The fact that also little web rolls are in contact with a rider roll and a rider roll load has been set for them does not help enough, for this load is very little in comparison with the weight of the web roll and with the friction forces acting at the ends of the roll cores. For example, a typical web roll, whose diameter is 1000 mm and whose width is 1 metre, weighs 500...1000 kilograms, depending on the density of the web roll, whereas a typical rider roll load with this diameter is 0.5...1.0 kN. The thrust forces at the ends of the roll cores have been measured, for example, as 25 kN, which, with a friction coefficient of 0.4 between the roll core ends, provides a force of 10.0 kN in the radial direction of the roll.

— The force of a hydraulic/pneumatic cylinder does not depend on its position, so that, when a jumping web roll raises a truncated rider roll, the rider roll load per roll is not changed. Thus, the situation is even worse than in a rider roll which has long rider rolls fixedly mounted on the rider roll beam: here the forces applied by the web rolls to the rider roll are transferred directly to the massive rider roll beam, in which beam the inertia of its mass increases the rider roll load in a quick disturbing movement of the web roll. In a prior-art solution the articulated rider roll units yield resiliently in compliance with the nature of the hydraulic/pneumatic cylinders and of their long hose systems for pressure medium.

— In the prior-art solution, the suspension of the rider roll units on the rider roll beam has no elastic spring at all, by whose means it would be effectively possible to affect the specific frequency of the rider roll unit, i.e. the frequency of oscillation of the web rolls up to which the rider rolls can follow

the disturbing movement of the web roll so that they remain constantly on the web roll face.

The object of the present invention is to provide an improvement over the prior-art winding methods. It is a further object of the invention to provide a device intended for disturbance situations of web rolls, which device can react to quick and very little situations of disturbance in the winding.

The method in accordance with the invention is characterized in that in disturbed winding the attachment of the rider roll unit/units to the rider roll beam is changed so that the rider rolls load the web rolls that are in a disturbed movement with a load substantially higher than the rider roll load of normal winding.

The device in accordance with the invention is characterized in that the device includes a device which is supposed to attenuate a disturbed movement of the web rolls and which changes the attachment of the rider roll unit/units to the rider roll beam so that the rider rolls are fitted to load the rolls that are in a disturbed movement with a load substantially higher than the rider roll load of normal winding.

In the present invention, it has been realized to provide a force considerably higher than a normal rider roll load to attenuate disturbed movements of the web rolls. In the invention, the forces are transferred from the rider roll unit to the rider roll beam.

In a preferred embodiment of the invention, a separate coupling is employed between the rider roll unit and the rider roll beam, said coupling being engaged irrespective of the position of the rider roll unit and exclusively when disturbed movements occur in the web rolls, in which connection the rider roll unit can be positioned at an arbitrary distance from the rider roll beam.

The movements of a rider roll unit produced by normal winding are characterized by slowness of the movement (diameter of the web rolls changes as the winding makes

progress) compared with the high speed of the disturbed movements (vibration of web rolls, jumping, etc.). The speed of the movement of setting of rider rolls on the web rolls is, for example, 1.2 mm per second when a difference of 20 mm is produced in the roll diameters as the web rolls grow from ϕ 500 mm to ϕ 800 mm at a running speed of 2500 metres per minute and when the thickness of the paper is 0.1 mm. Similarly, if the web rolls produce a sine-shaped disturbed movement in the rider roll, in which movement the amplitude from top to top is 0.7 mm and the frequency is 8 cycles per second, the maximal speed of this movement is 35 mm per second.

The connection with the rider roll beam can be rigid, in principle, but if a spring is added between the coupling and the rider roll beam, the following advantages are obtained:

1) The dynamic speed of the truncated rider roll can be brought to the desired level by means of different rigidities of the spring, i.e. the rider rolls can be made to remain constantly on the faces of the web rolls.

2) The force opposed to the movements of the web rolls can be regulated so that the movements remain as little as desired, and that no deformations arise in the web rolls, or no other disturbance except that arising from an excessive momentary nip force is produced in the web rolls, in which connection an extreme case would be a web break.

In a coupling for rapid movement, it is possible to utilize, for example, resistance to fluid flow (hydrodynamic coupling), a coupling controlled by an acceleration detector, or a coupling that utilizes the inertia of mass, etc. The operation of a hydrodynamic coupling is such that the coupling operates right from the beginning of the disturbed movement and, thus, differs from the construction and from the principle of operation of a conventional shock absorber.

One indicator of engagement of the coupling can also be the direction of movement, in which case engagement of the coupling takes place exclusively in connection with an upwards movement of the truncated rider rolls (e.g. self-activating friction).

The invention will be described in detail with reference to some preferred embodiments of the invention illustrated in the figures in the accompanying drawing, the invention being, however, not supposed to be confined to said embodiments alone.

Figure 1 is a schematic side view of a preferred embodiment of the method and the device in accordance with the invention.

Figure 2 is a front view of the embodiment shown in Fig. 1.

Figure 3 shows a detail of Fig. 2 on an enlarged scale partly in section.

Figure 4 shows a second preferred embodiment of the detail shown in Fig. 2 on an enlarged scale and partly in section.

Figure 5A illustrates the movement of the web roll and the rider roll load in a prior-art winder as a function of time.

Figure 5B illustrates the movement of the web roll and the rider roll load in a solution in accordance with a preferred embodiment of a winder in accordance with the invention as a function of time.

Figure 5C illustrates the movement of the web roll and the rider roll load in a solution in accordance with a second preferred embodiment of a winder in accordance with the invention as a function of time.

Figure 6 is a schematic side view of a second preferred embodiment of the method and the device in accordance with the invention.

In Fig. 1 the drum winder is denoted generally with the reference numeral 10. The drum winder 10 comprises the winding drums 11 and 12. The web rolls to be wound are denoted with the reference numerals 13a,13b, etc. The rider rolls 14a,14b, etc. are attached to fastening brackets 15a,15b, etc. The cylinders 19 that regulate the rider roll load have been attached from one end to the fastening brackets 15a,15b, etc. and from the other end to the fastening bracket 18. The cylinders that displace the rider roll beam 16 are denoted with the reference numeral 17. In Fig. 1 the truncated rider roll, which comprises the rider roll beam 16 and a number of rider roll units 200, is denoted generally with the reference numeral 100. The reference numeral 200 refers generally to the rider roll unit, which comprises a rider roll 14a,14b, etc. as well as a fastening bracket 15a,15b, etc.

In the embodiment shown in Figs. 1 to 3, the device meant for disturbance situations of the web rolls 13a,13b is denoted generally with the reference numeral 26. The device 26 consists of a hydrodynamic coupling 27 and a spring device 28. The cylinder in the hydrodynamic coupling is denoted with the reference numeral 29, the piston rod with the reference numeral 30, and the chamber with the reference numeral 31. Narrow flow passages 33 have been formed into the piston 32. The return valve is denoted with the reference numeral 34. The hydrodynamic coupling 27 operates as follows. In normal winding the winding proceeds undisturbed, and the load regulation cylinder 19 takes care of the rider roll load. When a disturbed movement takes place in the wire roll, which raises the rider rolls placed at the web roll/rolls concerned, the coupling 27 is "locked" and the movement is transferred to the spring 28, which is pressed, and, thus, the rider roll load is increased in compliance with the properties of the selected spring. When the web roll returns downwards, the compressed spring 28 returns the rider roll down equally quickly by means of the coupling 27, which is still locked. The spring device 28 can be, for example, a pack of cup springs or a spiral spring fitted around the piston rod.

By means of the arrangement shown in Figs. 1 to 3, the rider roll load can be increased, e. g., for a web roll whose diameter is 1000 mm and whose width is one

metre and weight 500...1000 kilograms, depending on the density of the web roll, to a value of, e.g., 20 kN after the web roll has raised the rider roll by 1.0 mm.

Thus, in Fig. 3, just one preferred embodiment of the construction of the coupling 27 is shown. Engagement of the coupling is based on an increased flow resistance with a change in speed, i.e. the cylinder fluid flows with almost no resistance also in narrow ducts with slow movements. In rapid movements, practically no flow can occur, and forces are transferred from one part to the other. With slow movement the hydraulic fluid has time to flow and there is no coupling between the parts.

In the embodiment shown in Fig. 4, the device meant for disturbance situations of the web rolls 13a,13b is denoted generally with the reference numeral 26a. In this embodiment the hydrodynamic coupling 27 is accomplished in a way slightly different from the hydrodynamic coupling 27 shown in Fig. 3. In the embodiment of Fig. 4, the flow ducts 33a have been made into the structure of the cylinder 29. It is also possible to use this solution as a load regulation cylinder by into the cylinder 29 passing a pressure p along the duct 35 illustrated by the dashed lines.

The embodiment shown in Fig. 4 permits the operation of the construction as a coupling 27 also without a piston 32. This permits minimizing of the friction to a level as low as possible.

Figs. 5A, 5B and 5C illustrate the conduct of a prior-art rider roll solution and of rider roll solutions of two different embodiments of the invention in a case in which, out of one reason or another, the web roll jumps up once from the winding bed along the face of one of the winding drums and returns down. The y-movement of the web roll 13a,13b, etc. illustrated in Figs. 5A,5B and 5C is illustrated by a solid line. The change in the rider roll load q is illustrated by a dashed line. The movement of the rider roll is illustrated by a dashed-dotted line. At the time t_1 the web roll starts rising, at the time t_2 it is at its highest point, and at the time t_3 the web roll has come down.

Fig. 5A illustrates a prior-art solution, in which the rider rolls are supported on the rider roll beam by means of pneumatic or hydraulic cylinders. For the sake of clarity of illustration, the movement of the rider roll, illustrated by the dashed-dotted line, during the time $t_1 \ldots t_2$ has been drawn slightly above the curve that illustrates the movement of the web roll. The rider roll follows the movement of the web roll during the time $t_1 \ldots t_2$, but, since the construction is dynamically slow, the rider roll has not time to follow the movement of the web roll, and it is separated from the web roll face at the time t_2, when the web roll starts moving y downwards. The rider roll again meets the roll face at the time t_4. Since the cylinder force does not depend on the position of the piston, the rider roll load q is not changed from its set value q_0 when the web roll rises. When the rider roll is separated from the web roll face at the time t_2, the rider roll load q falls down to zero. Similarly, at the time t_4 the rider roll load q rises momentarily to a very high level, and is finally set at its set value q_0.

Fig. 5B illustrates the operation of a rider roll when a hydrodynamic coupling is added to the rider roll unit between the rider roll unit and the rider roll beam. Also as shown in Fig. 5B, the rider roll is separated from the web roll face at the time t_2 and returns onto the web roll face at the time t_4, but the rider roll load q starts increasing directly as the web roll rises since the forces applied to the rider roll are transferred directly to the massive rider roll beam 16. This is why the movement of the web roll in the direction y remains shorter than in the case of a rider roll with no coupling. However, the rider rolls are separated from the web roll face at the time t_2, because now also the massive rider roll beam 16 is involved in the movement.

Fig. 5C illustrates a situation in which a spring device has been added between the hydrodynamic coupling and the rider roll beam. Now the rider roll remains on the web roll face, because the spring device provides the rider roll with a sufficient dynamic speed (increases the specific frequency). The rider roll load q is changed in accordance with the movement of the rider roll in compliance with the elastic constant of the spring device. Since the rider roll stays on the web roll face, there will be no nip force peak which deforms the web roll when the rider roll strikes

against the web roll face. Further, right after the web roll has come down at the time t_3, the rider roll is prepared to counteract a new rise of the web roll.

In Fig. 5C, the lower curve of the movement of the rider roll illustrates a spring that has not been pre-compressed, in which case the rider roll load starts increasing from the set rider roll load q_0, i.e. from the spring force 0. By means of pre-compression of the spring, a step-formed increase in the rider roll load is obtained before the rider roll starts rising, which is illustrated by the upper curve of dashed line. In Fig. 5C, the rider roll load corresponding to the pre-compression force of the spring is denoted with the letter q_e.

In the embodiment shown in Fig. 6, the acceleration detector is denoted with the reference numeral 40. The reference numeral 43 refers to a regulator, which controls the operations of the valves 44 and 45 so that the force of the loading cylinder 19, i.e. the cylinder force that determines the rider roll load, during normal winding is at the desired level. The acceleration detector 40 gives signal s to the regulator 41, which controls the valve device 42 so that the valve device 42 locks the hydraulic or pneumatic circuit so that no normal flow takes place, in which case the loading cylinder operates 19 in the way of a rigid piece. In such a case, the operation of the truncated rider roll 100 is similar to that illustrated in Fig. 5B.

By means of an acceleration detector 40, it is, of course, also possible to control other coupling actuators than, for example, a hydraulic valve. Similar "coupling actuators" are, for example, a disk brake and other couplings based on friction. Such coupling actuators can be placed in the same construction with the load regulation actuator, or separately from it.

Above, just some preferred embodiments of the invention have been described, and it is obvious to a person skilled in the art that numerous modifications can be made to said embodiments within the scope of the inventive idea defined in the accompanying patent claims.

Claims

1. A method in winding, wherein a number of separate web rolls (13a,13b, etc.) are formed around separate roll cores placed one after the other side by side while supported by support members (11,12) and while loaded by the rider roll loads produced by the rider rolls (14a,14b, etc.) in the rider roll units (200) in a truncated rider roll (100), **characterized** in that in disturbed winding the attachment of the rider roll unit/units (200) to the rider roll beam (16) is changed so that the rider rolls (14a,14b, etc.) load the web rolls (13a,13b, etc.) that are in a disturbed movement with a load substantially higher than the rider roll load (q_0) of normal winding.

2. A method as claimed in claim 1, **characterized** in that the attachment of the rider roll unit (200) is changed while controlled by a signal (S) given by an acceleration detector (40).

3. A method as claimed in claim 1, **characterized** in that the attachment of the rider roll unit (200) is changed by utilizing the flow resistance of fluid, the inertia of mass, or the direction of movement of a rider roll.

4. A device in winding, wherein a number of separate web rolls (13a,13b, etc.) are formed around separate roll cores placed one after the other side by side while supported by support members (11,12) and while loaded by the rider roll loads produced by the rider rolls (14a,14b, etc.) in the rider roll units (200) in a truncated rider roll (100), **characterized** in that the device includes a device (26,26a,42) which is supposed to attenuate a disturbed movement of the web rolls (13a,13b, etc.) and which changes the attachment of the rider roll unit/units (200) to the rider roll beam (16) so that the rider rolls (14a,14b, etc.) are fitted to load the web rolls (13a,13b, etc.) that are in a disturbed movement with a load substantially higher than the rider roll load (q_0) of normal winding.

5. A device as claimed in claim 4, **characterized** in that the device (26) meant for disturbance situations in the web rolls (13a,13b, etc.) is a coupling (27).

6. A device as claimed in claim 5, **characterized** in that the coupling (27) is attached to a spring device (28) which has been fixed to the rider roll beam (16).

7. A device as claimed in claim 5 or 6, **characterized** in that narrow flow passages (33) have been formed into the piston (32) of the coupling (27).

8. A device as claimed in claim 5 or 6, **characterized** in that narrow flow passages (33a) have been formed into the structure of the cylinder (29) of the coupling (27).

9. A device as claimed in claim 5 or 6, **characterized** in that the cylinder (29) of the coupling (27) is provided with a flow passage (35) for passing of pressurized medium into the cylinder (29).

10. A device as claimed in any of the claims 6 to 9, **characterized** in that the spring device (28) is pre-compressed.

11. A device as claimed in claim 4, **characterized** in that an acceleration detector (40) is fitted to give a signal (s) to a regulator (41) which controls the operation of the device (42) so that the flow of medium to the loading cylinders (19) of the rider rolls (14a,14b, etc.) is throttled.

12. A device as claimed in claim 11, **characterized** in that the device (42) is a valve which locks the flow in the hydraulic/pneumatic circuit.

13. A device as claimed in claim 4, **characterized** in that the acceleration detector (40) is fitted to control a disk brake, a coupling based on friction, or any other, equivalent coupling actuator.

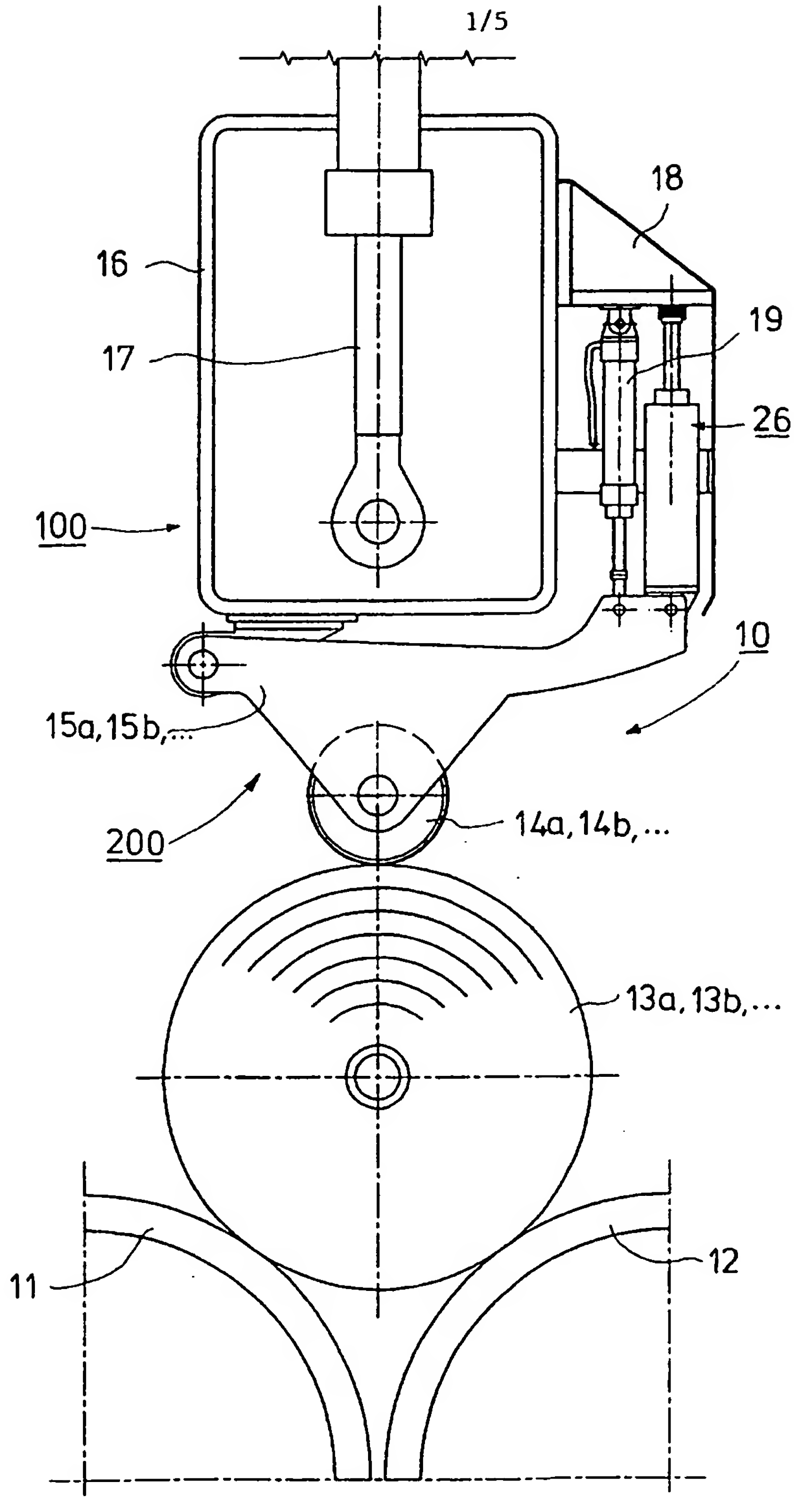


FIG. 1

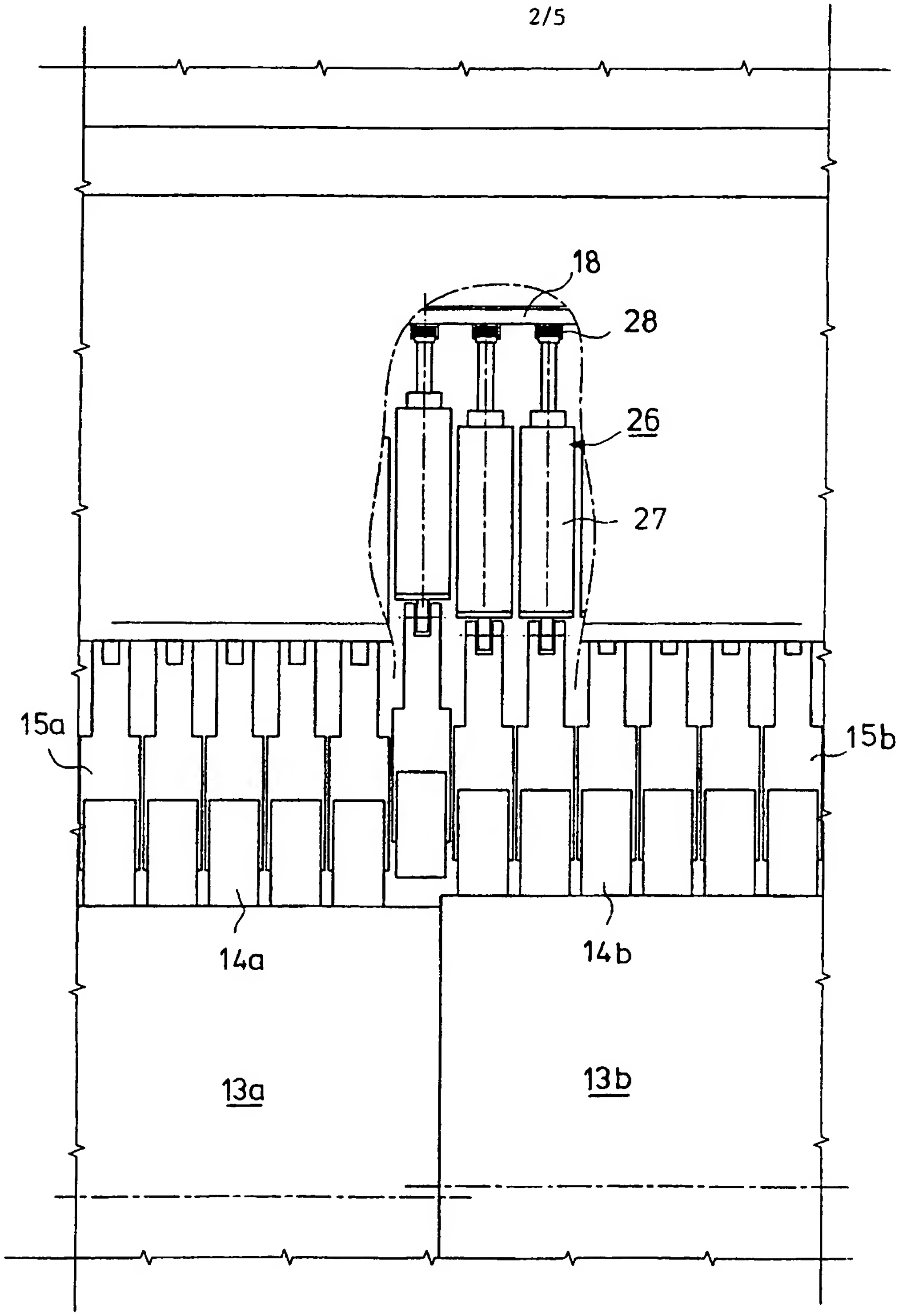


FIG. 2

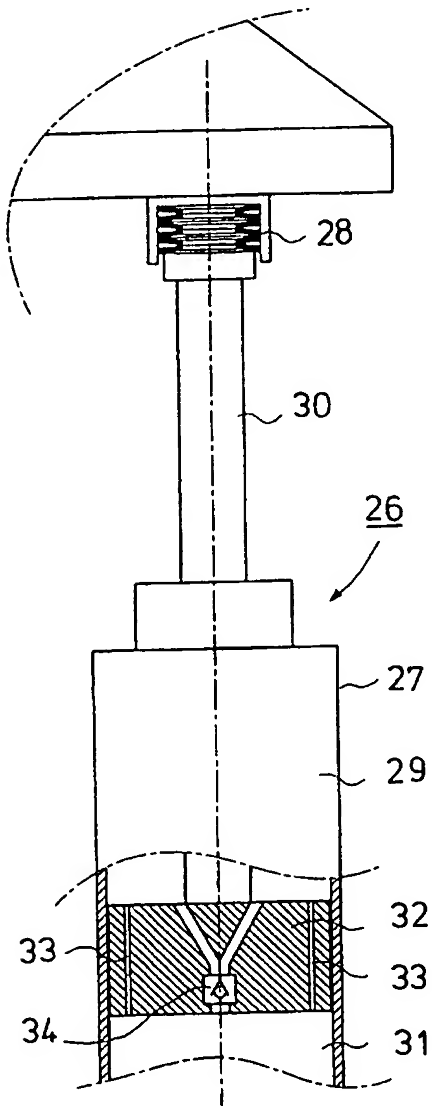


FIG. 3

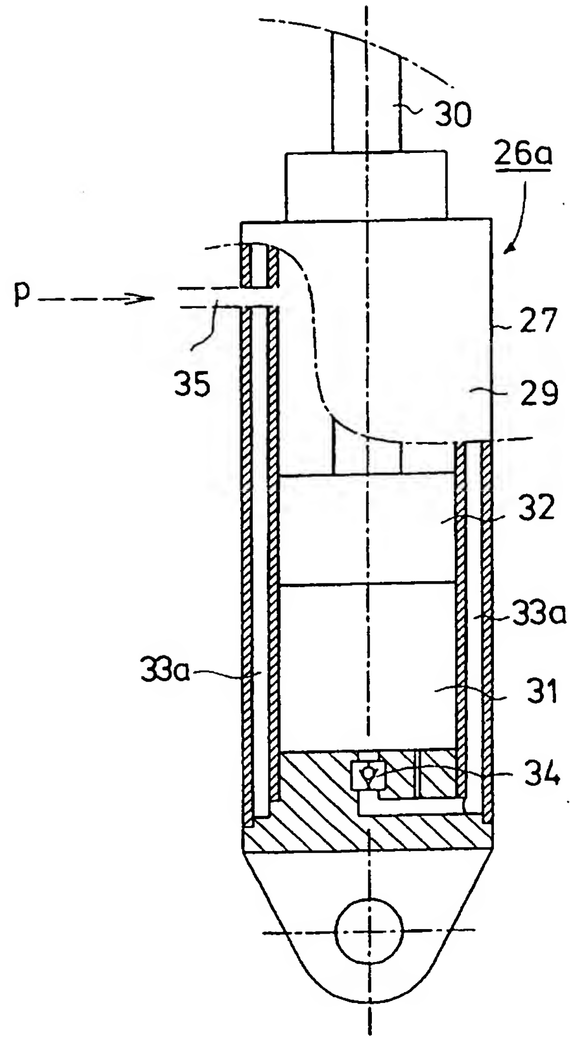


FIG.4

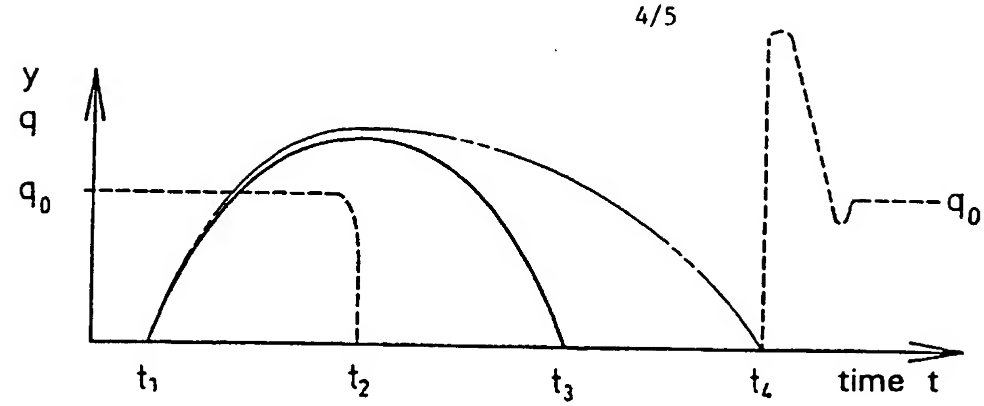


FIG. 5A

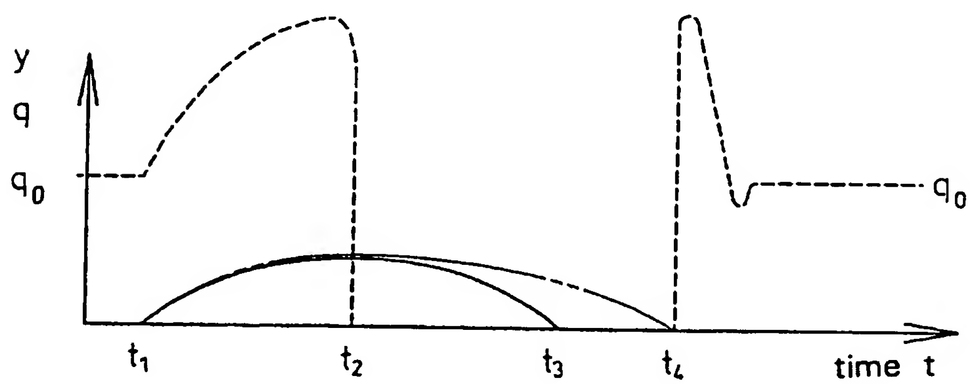


FIG. 5B

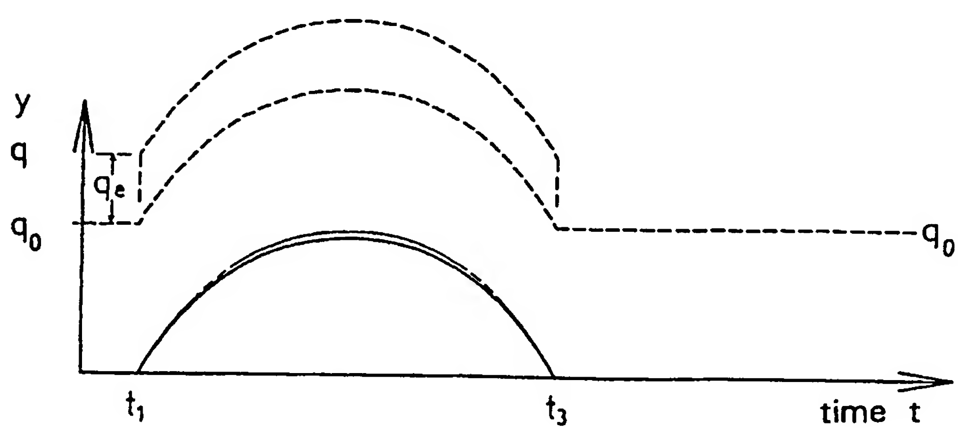


FIG. 5C

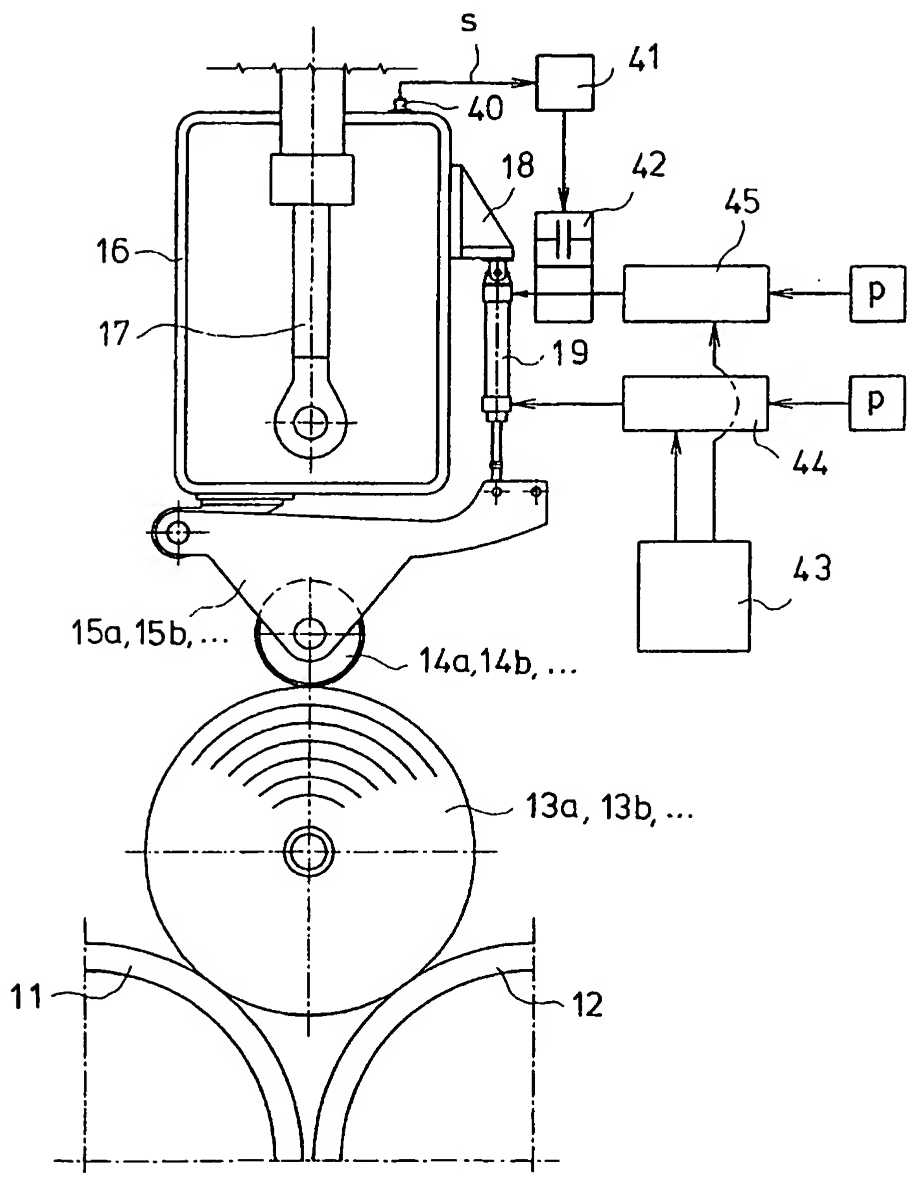


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 97/00358

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B65H 18/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5320299 A (D.C. FITZPATRICK ET AL), 14 June 1994 (14.06.94), column 6, line 42 - column 7, line 32	1,3,4,5
A		2,6-13
	--	
X	US 3837593 A (G.W. DÖRFEL), 24 Sept 1974 (24.09.74), column 4, line 49 - column 5, line 33	1,3,4,5
A		2,6-13
	--	
X	US 4095755 A (K.K. SNYGG ET AL), 20 June 1978 (20.06.78), column 1, line 41 - column 2, line 32	1,3,4,5
A		2,6-13
	--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" erlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 August 1997	01.09.97

Name and mailing address of the ISA/	Authorized officer
Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Stina Sjögren Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 97/00358

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 4402874 A1 (BELOIT TECHNOLOGIES, INC.), 3 August 1995 (03.08.95)	1-13
	--	
A	DE 3924612 A1 (JAGENBERG AG), 31 January 1991 (31.01.91)	1-13
	--	

INTERNATIONAL SEARCH REPORT
Information on patent family members

06/08/97

International application No.
PCT/FI 97/00358

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5320299 A	14/06/94	BR 9305794 A	18/02/97
		CA 2128533 A	05/08/93
		DE 611362 T	18/05/95
		DE 69304510 D,T	06/02/97
		EP 0611362 A,B	24/08/94
		SE 0611362 T3	
		JP 2535727 B	18/09/96
		JP 6510976 T	08/12/94
		PL 171493 B	30/05/97
		WO 9315009 A	05/08/93
US 3837593 A	24/09/74	AT 324114 B	11/08/75
		CA 973860 A	02/09/75
		DE 2147673 A	29/03/73
		GB 1366743 A	11/09/74
		SE 373175 B,C	27/01/75
US 4095755 A	20/06/78	AT 357861 B	11/08/80
		BR 7701392 A	20/12/77
		CA 1076089 A	22/04/80
		DE 2709740 A,B,C	15/09/77
		FR 2343677 A,B	07/10/77
		GB 1553536 A	26/09/79
		JP 52110909 A	17/09/77
		SE 7702685 A	13/09/77
DE 4402874 A1	03/08/95	AU 1537195 A	21/08/95
		CA 2181719 A	10/08/95
		EP 0743920 A	27/11/96
		FI 963012 A	30/07/96
		PL 315678 A	25/11/96
		WO 9521118 A	10/08/95
DE 3924612 A1	31/01/91	CA 2017017 A	26/01/91
		DE 59003203 D	00/00/00
		EP 0410093 A,B	30/01/91
		ES 2052094 T	01/07/94
		FI 96500 B,C	29/03/96
		JP 3079545 A	04/04/91
		US 5190235 A	02/03/93